OIPE JC103 MAY 13 2005 PATENT & TRADEMARK OFFICE

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PATENT

Docket No. 01SC135CO1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventors : Jeffrey T. Cheung and Hao Xin

U.S. Patent No : 6,861,772

Issued : Mar. 1, 2005

Serial No. : 10/783,202

Filed : Feb. 19, 2004 Group Art Unit: 2834

Certificate
MAY 18 2005
of Correction

Title: MULTIPLE MAGNET SYSTEM WITH DIFFERENT MAGNET PROPERTIES

Attn: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL REQUEST FOR CERTIFICATE OF CORRECTION OF APPLICANT'S MISTAKE

Sir:

Transmitted herewith is a Request for Certificate of Correction of Applicant's Mistake, Certificate of Correction form PTO/SB/44 (one page), and copy of the Preliminary Amendment filed February 19, 2004.

Check No. 23747 in the amount of **$100.00** is enclosed to cover the required fee for the Certificate of Correction of Applicant's Mistake under 37 CFR 1.323 §1.20(a). If any additional fee is required, the Commissioner is authorized to charge Deposit Account No. 11-1580. A duplicate of this transmittal is enclosed for the convenience of the Patent and Trademark Office.

Respectfully submitted,

May 10, 2005

Richard S. Koppel

05/16/2005 TBESHAH2 00000118 6861772

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U:\J\D1\ROCKWELL\01SC135CO1 Cert. of Correction Transmittal

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service as First Class mail in an envelope addressed to: Attn: Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on:

May 10, 2005
Date

Jenny Jirkovsky

MAY 20 2005

OIPE JC103 MAY 13 2005 PATENT & TRADEMARK OFFICE

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P.O. Box 1450
Alexandria, VA 22313-1450

REQUEST FOR CERTIFICATE OF CORRECTION OF APPLICANT'S MISTAKE

Sir:

This is a request for a Certificate of Correction to correct a mistake that was made in the Preliminary Amendment filed February 19, 2004 in the application for the above patent. Reference to parent patent application was incorrectly listed as Serial No. 10/078,17. The mistake in the Preliminary Amendment was carried over to the patent as issued.

In the above patent, in column 4, line 3, please delete "10/078,17" and insert -- 10/078,176 --.

A Certificate of Correction is respectfully requested.

Respectfully submitted,

May 10, 2005

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U:\U\D1\ROCKWELL\01SC135CO1 Certificate of Correction Request

PTO/SB/44 (04-04)
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UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 6,861,772

DATED : Mar. 1, 2005

INVENTOR(S) : Jeffrey T. Cheung and Hao Xin

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 4, line 3, delete "10/078,17", insert -- 10/078,176 --

MAILING ADDRESS OF SENDER:

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PATENT NO. 6,861,772

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⇨ 1 of 1

This collection of information is required by 37 CFR 1.322, 1.323, and 1.324. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1.0 hour to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Attention Certificate of Corrections Branch, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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MAY 20 2005

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Docket No. 1SC135C01 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Jeffrey T. Cheung, Hao Xin

Serial No. Unassigned

Filing Date: Concurrent

Title: MULTIPLE MAGNET TRANSDUCER WITH DIFFERENTIAL MAGNETIC STRENGTHS

Continuation of:
Serial No. 10/078,176 Examiner: Jones, Judson
Filed: February 19, 2002 Art Unit: 2834
For: MULTIPLE MAGNET TRANSDUCER WITH DIFFERENTIAL MAGNETIC STRENGTHS

Mail Stop Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT

Sir:

This Preliminary Amendment accompanies the above-identified continuation application. Kindly amend the specification and claims of the application as follows:

Specification

Paragraph at page 6, line 26 - page 7, line 23

To achieve the desired low level of friction, ferrofluid bearings are preferably employed as an interface between the magnets and enclosure. Ferrofluids are dispersions of finely divided magnetic or magnetizable particles, generally ranging between about 30 and 150 Angstroms in size, and dispersed in a liquid carrier. The magnetic particles are typically covered with surfactants or a dispersing agent. The surfactants assure a permanent distance between the magnet particles to overcome the forces of attraction caused by Van der Waal forces and magnetic interaction, and also provide a chemical composition on the outer layer of the covered particles which is compatible with the liquid carrier and the chemicals in the surrounding environment. Ferrites and ferric oxides employed as magnet particles offer a number of physical and chemical properties to the ferrofluid, including saturation magnetization, viscosity, magnetic stability and chemical stability. Several types of ferrofluids are provided by Ferrotec (USA) Corporation of Nashua, New Hampshire. A summary of patents related to the preparation of ferrofluids is provided in Patent No. 6,056,889, while the use of ferrofluid bearings in a moving magnet electrical generator is discussed in copending Patent Application Serial No. 10/078,724, entitled "Electrical Generator With Ferrofluid Bearings", filed on the same day as parent application Serial No. 10/078,17 to the present ~~invention~~ application by the present applicants and ~~also~~ assigned to Innovative Technology Licensing, LLC, which subsequently changed its name to Rockwell Scientific Licensing, LLC, the assignee of the present

invention. The contents of this copending application are hereby incorporated herein by reference.

Paragraph at page 8, lines 10-29

A preferred ferrofluid composition for the present invention has a viscosity substantially less than 5 cp, actually less than 2 cp, and achieves an ultra low coefficient of static friction in the range of 0.0008-0.0012. This is sensitive enough for a magnet on a beam to begin sliding when the beam is tilted only about 0.07 degrees off horizontal. This and other suitable ferrofluid compositions are discussed in copending Patent Application Serial No. 10/078,132, entitled "Mechanical Translator With Ultra Low Friction Ferrofluid Bearings", filed on the same day as parent application Serial No. 10/078,176 to the present ~~invention~~ application by applicant Jeffrey T. Cheung, and ~~also~~ assigned to Innovative Technology Licensing, LLC, which subsequently changed its name to Rockwell Scientific Licensing, LLC, the assignee of the present invention, the contents of which application are hereby incorporated herein by reference. The composition comprises a mixture of one part Ferrotec (USA) Corporation EFH1 light mineral oil ferrofluid mixed with from two to four parts of isoparaffinic acid, stirred for 24 hours. Suitable sources of isoparaffinic acid are Isopar G and Isopar M hydrocarbon fluids from ExxonMobil Chemical Corp.

Paragraph at page 11, line 17 - page 12, line 9

FIG. 4 is a calculated plot illustrating the multiple modes of vibration that result from a plural magnet system with ultra low friction bearings. This plot was made with the magnets assumed to have equal magnetic field strengths, and traces the velocity of one of the

magnets as a function of time. The enclosure is assumed to have a length that would result in a natural frequency of 1 Hz for a single-magnet system. With two magnets there are multiple modes of oscillation, corresponding to the several velocity peaks which occur during each one second period, for each magnet. .This makes the multiple magnet system more responsive to enclosure movements that do not match the system's natural frequency and/or are out-of-phase with the initial magnet movement. The increased responsiveness of multiple-magnet transducers with ultra low friction bearings is discussed in detail in copending Patent Application Serial No. 10/077,945, entitled "Multiple Magnetic Transducer", filed on the same day as parent application Serial No. 10/078,176 to the present ~~invention~~ application by the present applicants and ~~also~~ assigned to Innovative Technology Licensing, LLC, which subsequently changed its name to Rockwell Scientific Licensing, LLC, the contents of which application are hereby incorporated herein by reference. Similarly, multiple oscillation modes are produced with the multiple magnets of different field strengths which are the subject of the present invention.

Claims:

1. (currently amended) A dynamic magnet system, comprising:

a support structure, and

a plurality of magnets oriented successively in polar opposition for individual movement relative to each other and to said support structure, at least some of said magnets having mutually different properties.

2. (original) The dynamic magnet system of claim 1, said at least some magnets having different magnetic strengths.

3. (original) The dynamic magnet system of claim 2, said at least some magnets having substantially equal sizes.

4. (original) The dynamic magnet system of claim 1, said at least some magnets having different sizes.

5. (original) The dynamic magnet system of claim 4, said at least some magnets having substantially equal unit magnetic strengths.

6. (original) The dynamic magnet system of claim 1, further comprising respective bearings establishing static coefficients of friction between said magnets and said support structure less than 0.02.

7. (original) The dynamic magnet system of claim 1, further comprising ferrofluid bearings between said magnets and said support structure.

8. (original) The dynamic magnet system of claim 7, said ferrofluid having a viscosity less than 10 centipoise.

9. (original) The dynamic magnet system of claim 8, said ferrofluid comprising a light mineral oil medium mixed with isoparaffinic acid.

10. (original) The dynamic magnet system of claim 1, further comprising a conductor oriented with respect to said support structure and magnets so that movement of said magnets induces an electrical signal in said conductor.

11. (original) The dynamic magnet system of claim 10, said conductor comprising at least one coil wound on said support structure, said support structure being non-conductive.

12. (original) The dynamic magnet system of claim 10, further comprising an operating system powered by said signal.

13. (original) The dynamic magnet system of claim 1, further comprises a pair of end magnets limiting the travel of said moving magnets, said end magnets oriented in polar opposition to the nearest respective moving magnet.

14. (original) The dynamic magnet system of claim 1, said magnets having multiple oscillation modes relative to said support structure.

15. (original) The dynamic magnet system of claim 1, said support structure orienting said magnets for movement in a primarily horizontal direction.

16. (original) The dynamic magnet system of claim 1, said magnets oriented for movement along a common axis.

17. (original) The dynamic magnet system of claim 1, said system having a critical angle of displacement for said magnets from a horizontal static position of less than 1 degree.

18. (original) The dynamic magnet system of claim 17, wherein said critical angle is less than 10 minutes.

19. (currently amended) An energy harvester, comprising:

a support structure,

a plurality of magnets oriented successively in polar opposition for individual movement relative to each other, and to oscillate relative to said support structure in multiple oscillation modes, at least some of said magnets having mutually different properties,

respective bearings establishing static coefficients of friction between said magnets and said support structure less than 0.02, and

a conductor oriented with respect to said support structure and magnets so that oscillation of said magnets in response to a movement of said support structure induces an electrical signal in said conductor.

20. (original) The energy harvester of claim 19, said at least some magnets having different magnetic strengths.

21. (original) The energy harvester of claim 20, said at least some magnets having substantially equal sizes.

22. (original) The energy harvester of claim 19, said at least some magnets having different sizes.

23. (original) The energy harvester of claim 22, said at least some magnets having substantially equal unit magnetic strengths.

24. (original) The energy harvester of claim 19, said bearings comprising a ferrofluid.

25. (original) The energy harvester of claim 24, said ferrofluid having a viscosity less than 10 centi-poise.

26. (original) The energy harvester of claim 24, said ferrofluid comprising a light mineral oil medium mixed with isoparaffinic acid.

27. (original) The energy harvester of claim 19, further comprising an operating system powered by said signal.

28. (original) The energy harvester of claim 19, said support structure orienting said magnets for movement in a primarily horizontal direction.

29. (currently amended) An energy harvester, comprising:

a support structure,

a plurality of magnets oriented successively in polar opposition for individual movement relative to each other, and to oscillate relative to said support structure in multiple oscillation modes, at least some of said magnets having mutually different properties, and

a conductor oriented with respect to said support structure and magnets so that oscillation of said magnets in response to a movement of said support structure induces an electrical signal in said conductor,

wherein said harvester has a critical angle of displacement for said magnets from a horizontal static position of less than 1 degree.

30. (original) The energy harvester of claim 29, wherein said magnets have different magnetic strengths.

31. (original) The energy harvester of claim 29, wherein said critical angle is less than 10 minutes.

32. (original) The energy harvester of claim 29, further comprising an operating system powered by said signal.

33. (currently amended) The ~~A~~ dynamic magnet system of claim 1, ~~comprising:~~

~~a support structure, and~~

wherein said magnets comprise an even number of magnets ~~oriented in polar opposition to individually move relative to said support structure along a common axis, at least some of said magnets having mutually different properties~~.

34. - 42. (canceled).

43. (currently amended) The dynamic magnet system of claim ~~42~~ 1, further comprising an operating system powered by said signal.

44. - 47. (canceled).

48. (currently amended) A dynamic magnet system, comprising:

a support structure,

a plurality of magnets oriented successively in polar opposition ~~to move~~ for individual movement relative to each other and to said support structure, at least some of said magnets having mutually different properties, and

respective bearings establishing ultra low static coefficients of friction less than 0.02 between said magnets and said support structure,

said support structure orienting said magnets for primarily horizontal movement.

49. (original) The dynamic magnet system of claim 48, said at least some magnets having different magnetic strengths.

50. (original) The dynamic magnet system of claim 49, said at least some magnets having substantially equal sizes.

51. (original) The dynamic magnet system of claim 48, said at least some magnets having different sizes.

52. (original) The dynamic magnet system of claim 51, said at least some magnets having substantially equal unit magnetic strengths.

53. (original) The dynamic magnet system of claim 48, said bearings comprising a ferrofluid.

54. (original) The dynamic magnet system of claim 53, said ferrofluid having a viscosity less than 10 centipoise.

55. (original) The dynamic magnet system of claim 53, said ferrofluid comprising a light mineral oil medium mixed with isoparaffinic acid.

56. (original) The dynamic magnet system of claim 48, further comprising a conductor oriented with respect to said support structure and magnets so that movement of said magnets induces an electrical signal in said conductor.

57. (original) The dynamic magnet system of claim 56, further comprising an operating system powered by said signal.

58. (original) The dynamic magnet system of claim 48, said magnets having multiple oscillation modes relative to said support structure.

59. - 64. (canceled)

REMARKS

The amendment to the specification updates the citations for related applications mentioned in the specification, as well as a change of name for the assignee.

Each of the independent claims 1, 19, 29 and 48 remaining in the application after the entry of this Preliminary Amendment has been amended to require "a plurality of magnets oriented successively in polar opposition for individual movement relative to each other" and to a support structure. All of the independent claims also require that at least some of the magnets have mutually different properties.

Claim 1 was rejected in the parent application under 35 U.S.C. 102(b) as anticipated by both Patent No. 6,104,108 to Hazelton et al., and Patent No. 5,818,132 to Konotchick. Hazelton et al., however, is patentably distinguishable from the present invention at least because its various magnets are connected together, rather than being capable of individual movement relative to each other as required by the present claims, and because its magnets are not oriented in polar opposition. As described at column 4, lines 60-66, "Transverse permanent magnets 202a - 202d having alternately reversed magnetic polarities...are attached to a first side rail 204a, parallel to the xz-plane." Since the magnets are all attached to the side rail 204a, they cannot move relative to each other. Furthermore, although magnets 202a - 202b are shown as being oriented in polar opposition to each other, each successive pair of these transverse magnets is separated by a pair of wedge magnets 206a - 206h. The wedge magnets of each pair have a generally parallel polarity that is rotated approximately 90° from the transverse magnets on each side, and generally 180° from the next pair of wedge

magnets on the opposite faces of the adjacent transverse magnets. Thus, as the magnet array illustrated in FIG. 2a is traversed from left to right, the magnetic polarity generally rotates 90° clockwise between successive transverse magnets and pairs of wedge magnets. This is very different from having the magnets "oriented in polar opposition" as required by claim 1. To change the magnet array disclosed in Hazelton et al. to one in which the magnets are "oriented successively in polar opposition" would require the elimination of the wedge magnets, which would change the entire nature of the structure.

Konotchick discloses a structure in which "Moving magnet 2 is composed of three small disc magnets 2A, 2B and 2C held together by magnet force." (column 3, lines 26-28). Magnets 2A, 2B and 2C cannot move relative to each other, and thus do not anticipate claim 1. The purpose of the triple-magnet structure 2A/2B/2C of FIG. 2 in Konotchick was to implement the single moving magnet embodiment in FIG. 1 with a lower cost magnet structure (column 3, lines 6-22); magnets 2A, 2B and 2C effectively function as a ~~simple~~ single unified magnet. By contrast, the improved electric generating capability of the present invention results from the provision of multiple moving magnets with different magnetic properties, particularly magnetic strength (see specification page 6, lines 14-25). Nor can magnets 3, 4 of Konotchick be included in the "plurality of magnets" required by claim 1, since as acknowledged in the October 28, 2003 Office action in the parent application, these magnets are fixed. They thus do not move relative to a support structure. Furthermore, claim 1 requires "a plurality of magnets oriented successively in polar opposition for individual movement relative to each other." Konotchick's fixed end magnets 3 and 4 also do not satisfy this requirement.

Claim 19 was rejected under 35 U.S.C. 103(a) over Konotchick in view of Soloman et al., which was cited as teaching ferrofluid as a combination bearing and seal. However, claim 19 is patentably distinct from Konotchick for the same reasons as claim 1, with or without ferrofluid bearings. The addition of ferrofluid bearings to the Konotchick structure would result in something quite different from the presently claimed structure.

Claim 29 was rejected under 35 U.S.C. 103(a) over Konotchick as modified by Solomon et al. and Raj, with Raj cited as teaching a ferrofluid having a viscosity of less than 5 cp at 27° centigrade. However, claim 29 is also patentably distinct from Konotchick for the same reasons as claims 1 and 19. Even if Konotchick were modified as suggested, the resulting structure would still not correspond to claim 29.

Claim 48 was rejected under 35 U.S.C. 103(a) over Hazelton et al., in view of Solomon et al., and also Konotchick in view of Solomon et al. Patentable distinctions of claim 48 from both Hazelton et al. and Konotchick are similar to those for claim 1. These distinctions are independent of the ferrofluid bearings of Solomon et al.

In addition to the amendments to independent claims 1, 19, 29 and 48, claim 33 has been amended to depend from amended claim 1. While the requirement in claim 33 for an even number of moving magnets is believed to have independent patentability, the present amendment to claim 1 requiring that the moving magnets be oriented "successively" in polar opposition, and that they move relative "to each other", are clarifications of the original claim language that are applicable to claim 33 also. Since claim 33 in its original form inherently included the limitations made explicit in the present amendment to claim 1, making it depend

from claim 1 does not add any further limitations to claim 33.

Claims 34-42, 44-47 and 59-64 have been canceled to avoid duplication with other claims and an unnecessary claim proliferation, while claim 43 has been amended to depend from claim 1 rather than canceled claim 42.

In view of the present Preliminary Amendment, all of the claims remaining in the application are believed to be in proper form for allowance, and a Notice of Allowance is respectfully requested.

Respectfully submitted,

February 19, 2004

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Attorney for Applicant

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